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PRODUCTION METHOD OF NITRIDE CERAMIC WIRING SUBSTRATE

(Chikka butsu kei seramikku haisen kiban no seiho)

Noboru Yamaguchi et al

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Inventor	:	Yamaguchi et al
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Specification

1.Title of Invention

Production method of nitride ceramic wiring substrate

2. Scope of Patent Claims

(1) The production method of nitride ceramic wiring substrate is characterized in that the ceramic wiring substrate is obtained by forming a metal layer by the metallizing method on the surface of the baked nitride ceramic substrate. The aforementioned ceramic substrate surface is roughened with an etching agent, this roughened substrate is heat treated.

(2) The production method of nitride ceramic wiring substrate of Claim 1 is characterized in that the etching agent is selected from 1 of this group consisting of an alkali solution or fused substance such as KOH, NaOH, LiOH and a mixture of these of these can be used. Also, it can select from 1 of this group consisting of an acid solution or fused substance such as H2PO4, H2SO4, HNO2, HCL, HF and a mixture of these can be used.

(3) The metallizing method in the production method of nitride ceramic wiring substrate of Claim 1 or Claim 2 is a method of

[1] the numbers in the margin indicate pagination in foreign text

chemical plating process or after the chemical plating, a electrodissociation plating is performed.

3. Detailed explanation of invention

(Field of Technology)

The invention pertains to the production method of nitride ceramic wiring substrate used as an electronic substrate.

[Technology background]

Conventionally, the example of the method used for making the circuit board consisting of a wiring board such as a ceramic wiring substrate is used for a circuit made on a clean ceramic sheet before the making with a tungsten slurry, this method pertains to the baking as a whole system in a oxidizing atmosphere or the fine metal powder such as Ag/Pd, Ag/Pt, Au, Cu are mixed into a paste with glass. After the screen printed on the ceramics substrate, the glass is baked with a temperature that it will fused into the ceramic substrate, this is one example of the formation of the substrate. However, with this method, the detail wiring is poor since the wiring resistance is large and it is difficult to form the fine pattern. Also, since it contained the glass substance, the adhesion property is poor and a poor quality product is obtained. During use, the drawback is that problems are generated.

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The ceramic substrate and the copper sheet are bonded using a bonding agent. An etching resist film is formed on a certain part of the circuit, then the etching is removed from that part of the circuit. Then, a circuit is formed by peeling off the etching resist film. However, the bonding agent is a poor, the organic bonding agent have these drawbacks, poor thermal resistance, poor chemical resistance and poor dimensional stability so this method is generally not used.

An example of the production method of the ceramic wiring substrate is the method where the formation is carried out using a chemical plating method. However, the chemical plating method as described had the above mentioned drawbacks so not practical. In addition, it is difficult to obtain a strong enough bond between the substrate and the metal layer.

In general, the 1st requirement in the wiring substrate is to obtain a strong bonding force between the substrate material and the metal wiring. However, there is a serious problem to make this method work due to the drawbacks on the chemical plating method. One method to improve this bonding force on the organic group of wiring substrate material such as glass epoxy is that after the substrate surface is roughened up, it is metallized. The metal layer and the substrate are bonded physical by a so-called ankle effect. There were many examples in the production method of the wiring substrate such as the

oxide type ceramic. However, due to the abnormal heat transfer rate, the thermal expansion of the nitride ceramics such as nitride alumina and the silicon such as the chip are different, there is problem using the etching agent such as the acid or alkali. Therefore, after the substrate surface is roughened, metallizing cannot be performed.

[Purpose] The purpose of the invention is to focus on the above problems and offer a production method for the nitride group of ceramics wiring substrate where the bonding of the nitride group of ceramic and the aforementioned conductor can be stabilized, fine wiring pattern can be formed by the metal conductor and the strength of the nitride group of ceramics substrate is not damaged.

[Disclosure of the invention] The purpose of the invention is to resolve the above problems and offer a production method of nitride ceramic wiring substrate that is characterized in that the ceramic wiring substrate is obtained by forming a metal layer by the metallizing method on the surface of the baked nitride ceramic substrate. The aforementioned ceramic substrate surface is roughened with an etching agent, this roughened substrate is heat treated, a metal layer is formed.

The invention is explained below in detail by referring to the 1st implementation example accompanied by the diagrams.

(1) A baked nitride alumiceramic substrate is used. The material for the baked substrate is the use of the nitride ceramic in addition to the nitride alumi.

(2) The production method of nitride ceramic wiring substrate is characterized in that the etching agent is selected from 1 of this group consisting of an alkali solution or the fused substance such as KOH, NaOH, LiOH and a mixture of these of these can be used. Also, it can select from 1 of this group consisting of an acid solution or the fused substance such as H2PO4, H2SO4, HNO2, HCL, HF and a mixture of these can be used. The conditions for making the surface rough by the etching agent of the alkaline type are heating the etching agent to 100 - 400°C. The substrate is soaked in the heated etching solution and the surface is roughened or another method of roughening is by coating the substrate with the etching solution and then heating the substrate to 100 - 400°C. On the other hand, when using the acid group of etching agent, the above 2 methods are similar, the processing temperature is in the range of 80 - 400°. In either of these processing methods, the processing time is below 30 minutes. After the roughening, it is washed with water and dried.

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(3) After the aforementioned ceramic substrate surface is roughened with an etching agent, this roughened substrate is heat treated. The microcracks formed have little effect in the adhesive force of the metal layer on the coarse substrate. In addition, the substrate is washed sufficiently with water and it is verified that only a trace of the etching solution remained. The heat treating process is performed by removing the etching solution that remained and the microcracks. The processing temperature is suitable in this range, 1200 - 1500°C. If the processing temperature is less than 1200°C, the microcracks cannot be fused. On the other hand, if the processing temperature exceeds 1500°C, the whole ceramic substrate is burned. Therefore, the surface becomes uneven and this is ineffective for the bonding of the metal formed due to the roughness or the shape is modified so the bonding force of the metal layer is reduced. The processing time is not particularly limited but it is suitable within 15 minutes.

(4) The surface activation process is usually carried out. This process precipitates the metal palladium on the ceramic substrate surface by the sensitizing - activation method using a palladium chloride solution and the Iron (I) chloride solution.

(5) The chemical plating is performed. This usually involves the chemical plating process or the chemical nickel plating process.

(6) If necessary, electrodissociation plating is performed. For the electrodissociation plating, the thickness of the metal layer must be thick, the aforementioned chemical plating is performed on the substrate or copper plating or nickel plating can be performed.

(7) If necessary, the circuit formation such as etching is performed. Directly after this, chemical plating or electrodissociation are performed on this, the required circuit is formed. When the whole surface is plated, the circuit formation is performed by etching. The circuit formation is carried out using a commonly used method. According to the above production method, the basic characteristic of the nitride ceramic substrate is not damaged by using a weak acid or alkali such as nitride alumi, fine pattern can be formed with metal conductors of small wiring resistance. In addition, a nitride group of ceramics wiring substrate can be obtained with a uniform adhesion force between the metal layer and the nitride group of ceramic wiring substrate.

(Implementation example 1]

The nitride alumi ceramics baked substrate plate of thickness 0.635 mm is prepared. This substrate is soaked for 3 - 10 minutes in a phosphoric acid solution heated to 250 - 360°C, the substrate surface is roughened. After roughening, it is washed sufficiently with water and dried. After drying, it is put into an electronic oven in a nitrogen atmosphere and heated treated in the range of 1200 - 1400°C. The surface activation process is performed. The chemical copper plating process or the chemical nickel plating process are performed. Next, the metal layer of the nickel or copper formed by the electrodissociation plating is a thickness of 1 μm. The thickness of the metal layer is adjusted to 35 μm. Furthermore, after the roughening process of the above substrate, the surface roughness is Rmax of 3 - 5 μm, the curvature strength of the substrate before the roughening process is the same. Also, the substrate has a thickness layer adjusted to 35 μm. The circuit pattern is formed by the etching. The tensile strength in the L letter shape is measured and the 90 degree peel strength is measured.

(Implementation example 2]

The nitride alumi ceramics baked substrate plate of thickness 2.0 mm is prepared. This substrate is soaked for 5 - 10 minutes in an alkaline solution mixture (NaOH : KOH = 1:1)

heated to 150 - 250°C, the substrate surface is roughened. After roughening, it is washed sufficiently with water and dried. After drying, it is put into an electronic oven in a nitrogen atmosphere and heat treated in the range of 1300 - 1400°C. The same processes are carried out as in Implementation example 1.

A nitride alumi ceramic wiring substrate is obtained. The tensile strength in the L letter shape is measured and the 90 degree peel strength is measured.

Furthermore, the surface coarseness after the roughening process is Rmax of 2 - 6 μm.

(Implementation example 3)

The nitride alumi ceramic substrate of 1.5 mm thickness is prepared. This substrate is soaked for 5 - 10 minutes in an acid solution mixture (H_2SO_4: HNO_3 = 1:1) heated to 150 - 180°C or it is soaked 10 - 15 minutes in the H_2SO_4 solution, the substrate surface is roughened. After roughening, it is washed sufficiently with water and dried. After drying, it is put into an electronic oven in a nitrogen atmosphere and heated treated in the range of 1200 - 1400°C. The processing is carried out similar to implementation example 1. The nitride alumi ceramic wiring substrate is obtained. The

tensile strength in the L letter shape is measured and the 90 degree peel strength is measured.

Furthermore, the surface roughness after the roughening process is Rmax of 1 - 3 μm.

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(Implementation example 4)

The nitride alumi ceramic substrate of 1.0 mm thickness is prepared. A saturated solution of KOH, NaOH or LiOH are coated on this substrate surface. This is dried for 30 minutes in a dryer, then after the drying, this substrate is left in an electronic oven for 10 minutes heated to 400°C, the substrate surface is roughened. After roughening, it is washed sufficiently with water and dried. After drying, the processing similar to implementation example 1 is carried out, the nitride alumi ceramic wiring substrate is obtained. The tensile strength in the L letter shape is measured and the 90 degree peel strength is measured.

Furthermore, the surface roughness after the roughening process is Rmax of 3 - 7 μm.

Implementation example 5

The nitride alumi ceramics baked substrate plate of thickness 1.5 mm is prepared. This substrate is soaked for 5 - 10 minutes in an acid solution (H_2PO_4:H_2SO_4 = 10:5) heated to 150

- 180°C or it is soaked for 10 - 15 minutes in a concentrated H2SO4 solution, the substrate surface is roughened. After roughening, it is washed sufficiently with water and dried. A nitride alumi cerami wiring substrate is obtained similar to Implementation example 2. The tensile strength in the L letter shape is measured and the 90 degree peel strength is measured.

Furthermore, the surface roughness after the roughening process is Rmax of 2 - 6 μm.

Furthermore, the thermal conductivity, the thermal expansion, the curvature strength of the nitride alumi ceramic as the wiring substrate obtained with each of the implementation example are not reduced. In addition, the fine pattern and the wiring width and the wiring distance can be performed to 30 μm.

The 90 degree peel strength and the L letter shape tensile strength of the above implementation example are shown in Table 1.

第 1 表

	90°ピール強度 (kg/cm)	引き剥がし強度 (kg/mm²)
実施例1	1.0 ～ 1.5	2.3 ～ 2.6
実施例2	0.8 ～ 1.3	2.5 ～ 2.8
実施例3	0.6 ～ 0.8	2.0 ～ 2.5
実施例4	1.0 ～ 1.3	2.5 ～ 2.8
実施例5	1.0 ～ 1.3	2.3 ～ 2.6

Table 1 KEY:

	90 degree peel strength (kg./cm)	Peeling strength (kg/cm2)
Impl. Ex. 1		
Impl. Ex. 2		
Impl. Ex. 3		
Impl. Ex. 4		
Impl. Ex. 5		

According to the Table 1, the wiring substrate obtained from the implementation example have good bonding strength between the metal layer and the substrate.

The production method of the ceramic wiring substrate according to the invention is not limited to that in the implementation example but other nitride ceramic can be used.

(Effect of Invention)

The production method of the ceramic wiring substrate according to the invention as described above pertains to the roughening of the ceramic wiring substrate by an etching solution. The microcracking is not produced from the heat treatment and since metallizing is performed, the strength of the ceramic substrate is not damaged. Also, fine wiring pattern can be formed by the metal conductor and bonding strength of the conductor and ceramic can be strengthened

stably, an effective nitride ceramic wiring substrate can be produced.

4. Brief explanation of the diagrams

Figure 1 is the block diagram showing the production of the ceramic wiring substrate pertaining to the invention.

Agent: Matsumoto, Patent Attorney

Figure 1 KEY:

Nitride alumi ceramic substrate

Surface roughening of the ceramic surface

Heat treatment process of the ceramic surface

Surface activation of the ceramic surface

Chemical plating

Electrodissociation plating

Circuit formation by etching

Ceramic wiring substrate